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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/647,207	01/08/2001	Michael Stuke	HUBR1165 100	5279

24972 7590 08/03/2005

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EXAMINER	
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ART UNIT	PAPER NUMBER
1733	

DATE MAILED: 08/03/2005

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/647,207
Filing Date: January 08, 2001
Appellant(s): STUKE ET AL.

James R. Crawford
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 5/19/05.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection is correct.

(7) Claims Appendix

A substantially correct copy of appealed claim 23 appears on page 8 of the Appendix to the appellant's brief. The minor errors are as follows: "about" should not be underlined in part (d) since the after-final amendment dated 2/16/05 was entered.

(8) Evidence Relied Upon

The following is a listing of the evidence relied upon in the rejection of claims under appeal.

6,176,962	Soane et al.	1-2001
5,882,465	McReynolds	3-1999
3,997,386	Oshida et al.	12-1976
6,046,056	Parce et al.	4-2000

Soane et al. is directed to adhesive-free bonding of microfluidic devices. The reference teaches bonding a polymeric substrate having microchannels to a polymeric cover, which is made from the same material as the substrate, by applying uniform pressure while heating the substrate and cover to 2-5°C above the glass transition temperature of the polymeric materials, holding the substrate and cover at this temperature, and then slowly cooling the substrate and cover.

McReynolds is directed to adhesive-free bonding of microfluidic devices. The reference teaches bonding a polymeric substrate having microchannels to a polymeric cover by applying heat and pressure. The reference is not limited to a particular polymeric material and specifically states that the applied temperature and pressure will depend on the nature of the polymeric material used to make the device.

Oshida et al. is directed to adhesive-free bonding of polymeric substrates made from the same or different materials by heating the substrates to a temperature above their glass transition temperature(s) while applying pressure thereto and then cooling the substrates at a "slow cooling" rate, which is defined as 5°C/sec. The reference provides many examples where

polymeric substrates are bonded using the disclosed method where the total cooling time is about 11-12 seconds.

Parce et al. is directed to making a microfluidic device using a transparent polymeric cover and/or substrate.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 23-24, 26-29, 31-34, 36 and 45-46 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Soane et al. in view of McReynolds and Oshida et al.

With respect to claims 23 and 46, Soane is directed to adhesive-free bonding (column 5, lines 21-23) of microfluidic devices. The reference teaches preparing a polymeric substrate 12, which has depressions forming microchannels 21 and 23, and applying a polymeric cover 14 to the substrate by uniform pressure (Figures 5-6; column 2, lines 39-46 and 58-65). The reference teaches heating the substrate and cover to 2-5°C above the glass transition temperature of the substrate and cover, while still applying pressure to the cover, and holding the substrate and cover at this temperature of 2-5°C above the glass transition temperature (column 2, line 63 – column 3, line 4). Soane teaches slowly reducing/cooling the temperature of the substrate but fails to disclose any specifics pertaining to this cooling step (column 3, lines 6-9).

Therefore, Soane is silent as to Applicant's claimed pressure range, holding the substrate and cover at the heating temperature for at least 15 minutes, and cooling for up to 30 seconds down to a temperature of about 40°C.

It is known in the art to produce microfluidic devices using an adhesive-free bonding process, where a polymeric substrate having microchannels is bonded to a polymeric cover by the application of heat and pressure, as taught by McReynolds (column 3, lines 15-19 and 40-43; column 4, lines 24-26 and 33-36). McReynolds acknowledges that the applied temperature and pressure will depend on the nature of the polymeric material (column 4, lines 33-36); it being noted that McReynolds (column 3, lines 41-43) discloses polymers (i.e. polymethyl methacrylate) identical to those of the present invention (present claim 45) and Soane (column 9, line 66 – column 10, line 1).

Therefore, selection of a particular pressure range for the process of Soane would have been within purview of the skilled artisan at the time the invention was made depending on the polymeric material used because such is known in the art, as taught by McReynolds, wherein the skilled artisan would have been inclined to select a pressure range that produced a strong bond without deforming the substrate and/or cover.

As for holding the substrate and cover of Soane at the elevated temperature for a specific period of time, it is noted that Soane specifically points out that the temperature is held "for a **time period sufficient** to allow the polymer molecules to interpenetrate the polymeric surfaces of the substrate and cover and create a morphological bonding" (column 3, lines 1-4). The skilled artisan reading the reference as a whole would have readily appreciated that selection of such a time period would have been determined by the polymeric materials used, such that the

polymer molecules have sufficient time to interpenetrate the surfaces of the substrate and cover in order to create a satisfactory bond; it being noted that Soane teaches polymeric materials (i.e. polymethyl methacrylate; column 9, line 67 – column 10, line 1) identical to those of the claimed invention (see claim 45).

It is known in the art to bond two polymeric substrates made from the same or different polymeric materials using an adhesive-free bonding process wherein the substrates are pressed together while heating them to a temperature above their glass transition temperatures while applying pressure thereto, as taught by Oshida (abstract; column 1, lines 6-8; column 1, line 30 – column 2, line 5); it being noted that Oshida, like the present invention and Soane, teaches the substrates can be polymethyl methacrylate (Table in column 3). The substrates are then subjected to "slow cooling" while maintaining the applied pressure so as to prevent overcooling (column 2, lines 34-36).

Oshida defines "slow cooling" as a cooling rate of about 5°C/sec where the adjective "slow" refers to the number of degrees the temperature of the substrates is reduced/cooled per unit time and NOT the total amount of time that cooling takes place (column 2, lines 33-36; column 3, lines 5-9) – see example 1 where Oshida teaches bonding polymeric substrates by heating above the glass transition temperature to about 110°C and then cooling to 55°C at a rate of 5°C/sec (column 3, lines 25-27), which gives a total cooling time of about 11 seconds – also note examples 2-8 summarized in Table where Oshida bonds a variety of other polymeric materials using the disclosed method such that the total cooling time is about 11-12 seconds [(Tmax – Tnp)/5 = total cooling time].

Since Soane wants to cool the substrates by "slowly reducing" the temperature (column 3, lines 6-9), it would have been obvious to the skilled artisan to slowly reduce the temperature of the substrates of Soane using the "slow cooling" of Oshida such that the substrates are cooled at a rate of 5°C/sec because this prevents overcooling of the substrates (Oshida; column 2, lines 34-36).

As for a particular temperature to cool down to, selection of such would have been within purview of the skilled artisan depending on the polymeric materials used such that sufficient cooling is achieved so as to prevent delamination; it being noted that cooling polymeric materials down to temperatures similar to "about 40°C" (i.e. 55°C, 25°C as disclosed by Oshida - see examples in column 3) is known in the art.

As for a cooling time – if the skilled artisan were to use the polymethyl methacrylate provided in the example of Soane (column 9, line 66 – column 10, line 1), which has a glass transition temperature of about 105°C (Perry's chemical engineering handbook), heat it to about 3°C above this temp (= 108°C) as taught by Soane, and then cool it at a rate of 5°C/sec, as taught by Soane in view of Oshida, down to about 40°C a total cooling time of about 14 seconds would take place – it being noted such a cooling time falls within Applicant's claimed range of "for up to 30 seconds."

The examiner would like to point out that Oshida teaches the substrates undergoing further "natural cooling" upon exposure to room temperature after "slow cooling" has taken place (column 3, lines 28-30); however, the examiner would also like to point out that the present invention teaches "cooling up to 30 seconds" taking place within a cabinet in which the device was heated and then removing the cooled device from the cabinet (p. 4, lines 13-15; p. 5, lines 5-

8), wherein the skilled artisan would have appreciated that like the device of Oshida, the device of Soane would also undergo "natural cooling" when removed from the cabinet since it would be exposed to room temperature.

Regarding claims 24, 29, and 45, Soane teaches using polymethyl methacrylate for the substrate and cover (column 9, line 67 – column 10, line 1).

Regarding claims 26-28, Soane teaches the depressions being 50-750 μm (column 1, lines 35-43).

Regarding claims 31-32, Applicants are directed to the rejection of claim 23 set forth above.

Regarding claims 33 and 36, Applicants are directed to the rejection of claim 23 set forth above.

Regarding claim 34, Applicants are directed to the rejection of claim 23 set forth above.

Claim 30 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Soane et al., McReynolds and Oshida et al. as applied to claim 23 above, and further in view of Parce et al.

Regarding claim 30, Soane is silent as to at least the cover being transparent. It would have been obvious to the skilled artisan at the time the invention was made to use a transparent polymeric cover and/or substrate for those of Soane because such is known in the microfluidic device art, as taught by Parce (column 8, lines 57-66; column 9, lines 7-15), and this enables the microfluidic device to include a visual detection element (Parce; column 8, line 65 – column 9, line 3).

(10) Response to Arguments

In the 2nd paragraph on page 4 of the arguments, Applicant argues that Oshida does not disclose that there are depressions in the substrates and therefore Oshida is not concerned with solutions providing a smooth crack-free bond between two components, specifically where the depressions are formed. Applicant goes on to argue that Oshida is not clear about how the contact surfaces should look.

The examiner appreciates that Oshida does not disclose depressions in the substrates but like Soane and McReynolds, Oshida is concerned with thermally bonding (= adhesive free bonding) polymeric materials. More importantly, Oshida, like Soane, is concerned with thermally bonding similar polymeric materials by heating the materials above their glass transition temperatures while applying pressure thereto and then slowly cooling the materials. Oshida teaches slowly cooling the substrates at a rate of about 5°C/sec to prevent overcooling and therefore one skilled in the art would have been motivated to slowly cool the substrates of Soane at a rate of 5°C/sec for this same reason - regardless of whether or not Oshida teaches the substrates having depressions.

In the 3rd and 4th paragraphs on page 4 and the 1st paragraph on page 5 of the arguments, Applicant argues with respect to a few of the examples provided in Oshida that the reference does not teach Applicant's claimed pressure range, holding time, and cooling down to 40°C.

The examiner points out that Oshida was only used to show it being known in the art to thermally bond similar polymeric materials by heating to a temperature above their glass transition temperatures while applying pressure thereto and then slowly cooling at a rate of 5°C/sec where a total cooling time of about 11-12 seconds takes place.

In the 4th and 5th paragraphs on page 5 of the arguments, Applicant argues that neither Soane nor McReynolds teaches Applicant's claimed holding time.

The examiner invites Applicant to reread the rejection set forth above. To reiterate, Soane specifically points out that the temperature is held "for a **time period sufficient** to allow the polymer molecules to interpenetrate the polymeric surfaces of the substrate and cover and create a morphological bonding" (column 3, lines 1-4). The skilled artisan reading the reference as a whole would have readily appreciated that selection of such a time period would have been determined by the polymeric materials used, such that the polymer molecules have sufficient time to interpenetrate the surfaces of the substrate and cover in order to create a satisfactory bond; it being noted that Soane teaches polymeric materials (i.e. polymethyl methacrylate; column 9, line 67 – column 10, line 1) identical to those of the claimed invention (see claim 45).

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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July 27, 2005

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